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FUNGICIDAL SCREENING TESTS FOR THE CONTROL OF DECAY IN FLORIDA ORANGES

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Report of a study made under the
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Division of Fruit and Vegetable Crops and Diseases

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FUNGICIDAL SCREENING TESTS FOR THE CONTROL OF DECAY IN FLORIDA ORANGES

The purpose of this report is to give the results of screening tests made with fungicidal materials during the past few years in an attempt to find a satisfactory decay inhibitor for citrus fruits.

Mild antiseptics such as permanganate of potash, blue stone, and borax have long been used in attempts to check decay in citrus fruits. Their use has never attained universal acceptance, mainly because they failed to give the degree of control demanded by the industry. To be entirely satisfactory, they must possess high fungicidal properties, and at the same time be non-injurious both to the commodity and to those who consume it over a long period. It is assumed that the protectant must be capable of penetrating into the tissues of the rind as well as the stem parts in order to check the growth of the several rot-producing fungi. *Phomopsis citri* and *Diplodia natalensis* become established in or on the stem parts months before the fruit is harvested and remain in a more or less quiescent state until after the fruit is picked; then they become active again. The Penicillia enter the small wounds and abrasions made during harvesting and handling and are capable of causing rapid decay. A number of chemicals that would give the desired degree of decay control are so toxic to animals that their use on foodstuffs is not permissible; yet it is reasonable to assume that if the search is carried on long enough, someone will find an excellent decay inhibitor that meets all

requirements of the health authorities. With this objective in view the U. S. Department of Agriculture, Subtropical Fruit Field Station at Orlando, Florida, has for several years made a search for an outstandingly effective but safe material for treating citrus fruits to prevent the development of decay at any time during the marketing period. More than a thousand compounds of established or assumed fungicidal or fungistatic properties were used on oranges in screening tests to determine their decay-inhibiting qualities. Of this number only a few were outstanding for rot control.

While some of the chemicals tested were purchased, most of them were supplied gratis by commercial agencies after they had made certain screening tests against plant diseases or their causal agents in pure culture.

A fair number of materials under study at this laboratory were screened against pure cultures of Phomopsis citri, Diplodia natalensis, Penicillium digitatum, and italicum, grown on potato dextrose agar in petri dishes. This method of screening was soon found to bear no consistent relation to results obtained from tests on fruit itself. Several materials that showed up well in culture failed when applied to the fruit, and vice versa. Therefore, it seemed more feasible to start at the beginning by using fruit such as would be encountered in commercial operations.

III

Experimental procedure

These studies were confined almost exclusively to oranges that were ripe enough for market at the time of the testing under discussion. Such varieties as Parson Brown, Hamlin, Seedling, and Valencia produced on mature trees were used in their respective ripening seasons. Upon delivery of the oranges to the laboratory from the groves, all lots of fruit were washed. While still wet they were transferred to a room maintained at 85° and 90 percent relative humidity. Here they were subjected to ethylene gas for 48 to 72 hours to accelerate the development of stem-end rot. However, the gassing treatment renders fruit less liable to green mold rot.

The fruit was treated within a few hours after the gassing period. Two methods of treatment were followed: (1) A dip in a solution of several concentrations of material under study, or a suspension in the case of insoluble materials; and (2) Fumigation, using different concentrations of the fumigant. In the case of the former the fruit was immersed for a fixed period of 10 seconds in varying concentrations of the chemical in water or in its appropriate diluent. In some instances the materials under test were not soluble in water or in alcohol but were soluble in acetone. These were first dissolved in acetone and then diluted with water or alcohol; in some instances an emulsifying agent such as Triton was added to the mixture. Some of the insoluble materials were applied as aqueous dispersions or

suspensions, aided by the addition of an emulsifying agent such as Triton. None of the treated lots was rinsed subsequently to remove the adhering chemicals. The dipped fruit was placed in trays to dry in the open air and then transferred to a holding room maintained at 70 degrees.

A small number of fumigants were tested. They were released in varying proportions in a chamber of approximately 18 cubic feet capacity equipped with a fan which ran continuously and with a thermostatically controlled hot plate that maintained the chamber at approximately 85 degrees. The test fruit was given a uniform exposure of 16 hours to the fumigant, then removed to open air for several hours before transfer to the holding room.

In the case of certain subliming materials, fruit wraps were treated with an alcoholic solution of the compound, allowed to dry, and the treated wraps applied to fruit which was stored for varying lengths of time.

These screening tests should be regarded as exploratory in nature; hence they do not necessarily give an accurate appraisal of the citrus decay inhibiting properties of the compound under test. Experience has shown that stem-end decay inhibiting properties of most materials give a higher degree of control in the fall and early winter when Diplodia is the principal cause of stem-end rot than in late spring when Phomopsis is the principal cause of stem-end decay. During the winter months Penicillium digitatum is frequently the dominant type of decay encountered in commercial operations. Specifically borax gives much better control of decay in the fall than it does in the spring. The same is true with 2-amino-pyridine, but the latter under all conditions of test has given a far greater degree of control than the former. Thus

tests made in the fall do not necessarily give a true appraisal of the efficacy of a material in checking decay at other seasons. Regardless of the season, whenever a material gave very good to excellent results it was retested later under different seasonal conditions. Some compounds such as diphenyl and sodium ortho-phenyl-phenate gave very good results for one or two weeks but failed to inhibit decay for long periods.

In addition to the materials listed in the following tables a fair number of compounds were screened and evaluated, but in defefence to the requests of our cooperators the identity of these materials and their effectiveness are withheld for the present. These will be listed in the first report following the lifting of the restrictions by our cooperators. It is only fair to state, however, that none of these restricted compounds gave outstanding results.

Results

It will be noted from the following table that not more than a dozen compounds possessed the desired degree of decay inhibiting properties. A few of these caused so much rind injury that they probably could not be used, while quite a number actually stimulated the development of decay without causing visible rind injury.

Thus far the results of feeding experiments to ascertain whether the material could be applied to oranges without detriment to the consumer of treated fruit have not been released, and until the material in question meets the requirements of the food authorities it cannot

be used in commercial operations. However, the decay inhibiting results are recorded in the following table for the possible guidance of those who might be interested in developing better screening methods or to aid in the selection of materials for future evaluations.

Citrus decay control obtained in screening tests with various chemicals during the past few years, to and including season 1947-48.

KEY

A - signifies excellent control of decay; check 10 times as much or more decay as treated lots.
B - " good " " " ; " 5 to 9 " " " " " " "
C - " fair " " " ; " 2 to 4 " " " " " " "
D - " poor to negligible control of decay; check less than 2 times as much decay" "
F - " fumigant, applied in 18 cu. ft. chamber.
DNR - " fruit dipped but not rinsed afterwards.
DR - " " " and " "
P - " powder applied with brush.
KADS - " potassium acid aldehyde sulfonate
W - " water
Al - " alcohol
O - " organic solvent other than alcohol.
WD - " dispersed in water.
ALD - " dispersed in alcohol.
T - " talcum powder.
WWE - " Water wax emulsion.
E - " emulsion.
PW - " paper wrap.
* - " rind injury at higher concentrations.
** - " " " " all concentrations.

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
243	1,3-Bis(hydroxymethyl) thiourea	5	DNR	W	A
655	p-Chloroacetophenone oxime	5	DNR	Al	A *
245	1-Hydroxymethyl thiourea	5	DNR	W	A
1155	8-Hydroxy quinoline sulfate	5	DNR	W	A *
255	Phenyl urethane	5	DNR	Al	A *
876	8-Quinolinol sulfamate	5	DNR	W	A
273	Sodium 2-mercaptothiazoline	5	DNR	W	A
676	Thiocarbamide	5	DNR	W	A
515	2,4,5,Trichlorophenyl acetate	5	DNR	W	A **
241	2-Aminopyridine	10	DNR	W	A
	Chloropicrin	1	F	--	B
258	4-Chloro-3,5-xylenol	5	DNR	O	B **

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
675	Diphenylamine	5	DNR	Al	B *
656	Ethyl p-chlorocarbanilate	5	DNR	Al	B **
	Mercuric chloride	1-4000	DNR	Al	B
801	Nickel thiourea chloride	5	DNR	W	B *
137	Sodium ethyl mercurithiosalicylate	1-1000	DNR	Al	B *
516	2,4,6,Trichlorophenyl acetate	5	DNR	W	B **
866	Acetyl thiourea	Saturated solution	DNR	W	C
846	Allylthiourea	5	DNR	Al	C *
358	2-Amino-3-methylpyridine	5	DNR	W	C
359	2-Amino-4-methylpyridine	5	DNR	W	C
360	2-Amino 6-methylpyridine	5	DNR	W	C
589	Atabrine, dihydrochloride dihydrate	5	DNR	W	C
256	Benzhydrol	10	DNR	Al	C *
24	Biphenyl (practical)	2	PW	Al	C
503	2-Biphenylyl acetate	5	DNR	Al	C *
566	2-Biphenylyl propionate	5	DNR	Al	C **
	Borax	8	DNR	W	C
	Boric acid	8	DNR	W	C
537	3-Butoxythiopropionamide	5	DNR	Al	C *
891	Butyl carbanilate	5	DNR	Al	C
863	1-(p-sec.-Butylphenoxy)-2-propanol	5	DNR	Al	C **
661	1-(p-tert-Butylphenoxy)-2-propanol	5	DNR	Al	C
375	p-Chloranilinomethyldimethyl-dithiocarbamate	Saturated solution	DNR	Al	C
862	p-Chloroacetophenone oxime	5	DNR	Al	C **
824	Copper 8-quinolinolate	5	DNR	Al	C **
868	2,6-diaminopyridine hydrochloride	5	DNR	W	C
94	(1,2-Dibromo-2-nitroethyl) benzene	5	DNR	Al	C **
649	3,5-Dibromosalicylaldehyde oxime	5	DNR	Al	C
242	Dichlorocyanoacetamide	5	DNR	W	C
651	2,4'-Dihydroxybenzophenone	5	DNR	Al	C *

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
440	Diphenylamine	5	DNR	Al	C
276 and 277	Diphenyl sulfoxide and Benzhydrol	10	DNR	W	C
103	Ethylenebis (dithiocarbamic acid), calcium salt polyhydrate	5	DNR	W	D
879	Ethyl carbanilate	5	DNR	Al	C
819	8-Hydroxyquinoline salicylate	5	DNR	Al	C *
240	2-Imidazolidinethione	Saturated solution	DNR	W	C
880	Iso-Propyl carbanilate	5	DNR	Al	C *
	KADS – See Potassium acid aldehyde sulfonate				
925	Lithium p-Chlorophenylcyanamide	5	DNR	Al	C **
977	Lithium nitrate	5	DNR	W	C
813	Phenyl mercury triethanolamine lactate	Saturated solution	DNR	W	C **
	o-Phenylphenol	2	DNR	W	C *
507	o-Phenylphenol, barium salt	100	P	--	C *
509	o-Phenylphenol, diphenylguanidine salt	5	DNR	Al	C
319	KADS, Chlorobenzene condensation product	5	DNR	W	C
	Potassium metaborate	8	DNR	W	C
	Potassium tetraborate	8	DNR	W	C
652	3-Pyridol	5	DNR	Al	C
589	Quinacrine, dihydrochloride dihydrate	5	DNR	W	C
826	8-Quinolinol acetate	5	DNR	W	C
32	8-Quinolinol condensation product	4	DNR	W	C
805	8-Quinolinol maleate	5	DNR	WD	C
711	8-Quinolinol phosphate	5	DNR	W	C **
543	8-Quinolinol sulfate	5	DNR	W	C **
15	Sodium chloro-2-phenyl-phenol	2	DR	W	C *
15	do	2	DNR	WWE	C *
301	Sodium diethyldithiocarbamate	5	DNR	W	D
	Sodium metaborate	8	DNR	W	C
13	Sodium o-phenylphenate	2	DR	W	C *
13	do	4	DNR	WWE	C *

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
11A	Sodium pentachlorophenol	2	DR	W	C *
	do	2	DNR	WWE	C *
	Sodium perborate	8	DNR	W	C
11	Sodium 2,3,4,6-tetra-Chlorophenol	2	DR	W	C *
	do	2	DNR	WWE	C *
12	Sodium 2,4,5-Trichlorophenol	2	DR	W	C *
	do	2	DNR	WWE	C *
485	Succinimide	5	DNR	Al	C
517	Tetrachlorophenyl acetate	5	DNR	W	C **
843	Thioacetamide	5	DNR	W	C *
244	Trichloroacetamide	Saturated solution	DNR	W	C
653	2,4,5-Trichlorophenyl acetate	5	DNR	Al	C **
481	2,4,6-Trichlorophenyl acetate	5	DNR	Al	D
65	Acenaphthene	Saturated solution	DNR	Al	D
682	Acetamide	5	DNR	W	D
602	Acetic acid	5	DNR	W	D * 1/
602 and (mixed) 594	Acetic acid glacial, copper acetate	5	DNR	W	D *
86	Acetyldimethyldithiocarbamylsulfamide	5	DNR	W	D
642	Acetylene-3,3'-diphthalide	Saturated solution	DNR	Al	D
693	Acetylsulfathiazole	do	DNR	Al	D
492	Acetylurea	1.5	DNR	W	D
	Alcohol	95	DNR	W	D
927	Acrylamide	5	DNR	W	D *
935	Acrylic acid	5	DNR	W	D *
216	Acrylonitrile dypnone, reaction product and H_2	5	DNR	W	D
577	dl-Alanine	5	DNR	W	D
588	Alkylated aryl poly-ether alcohol	1-1000	DNR	W	D
202	Alkyldimethylammonium bromide	5	DNR	W	D
812	Alkyldimethylbenzylammonium chloride	5	DNR	W	D
467	Alkyldimethyl-3,4-dichlorobenzylammonium chloride	5	DNR	W	D

1/ Rind injury at 125° only.

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or	Results
		Percent			
814	Alkyl quaternary ammonium bromide	Saturated solution	DNR	W	D
827	Allyl alcohol	5	DNR	W	D
885	Allyl N-(alphanaphthyl)carbamate	Saturated solution	DNR	Al	D
659	2-Allyl-4-chlorophenyl acetate	5	DNR	Al	D **
887	Allyl N-cyclohexylcarbamate	5	DNR	Al	D **
780	Allyl 2,4-dichlorophenoxyacetate	5	DNR	O	D **
886	Allyl N-methylcarbamate	5	DNR	Al	D
657	o-Allylphenylacetate	5	DNR	Al	D **
663	Allyl 2,4,5-trichlorophenyl ether	5	DNR	Al	D *
628	alpha-Pipecoline	5	DNR	W	D
425	4-Aminoacetamide	5	DNR	WD	D
587	Aminoacetic acid	5	DNR	W	D *
476	9-Aminoacridine	Saturated solution	DNR	Al	D
520	9-Aminoacridine hydrochloride powder	do	DNR	Al	D
756	m-Aminobenzoic acid	5	DNR	Al	D
622	p-Aminobenzoic acid	5	DNR	Al	D
650	p-Aminobutyrophenone	5	DNR	Al	D
645	p-Aminoenanthophenone	5	DNR	Al	D
445	o-Aminobiphenyl	5	DNR	Al	D
592	p-Aminoethyl benzoate	5	DNR	Al	D
777	1-(Aminoethyl)-2-heptadecylglyoxalidine	5	DNR	Al	D
629	2-Aminoheptane	5	DNR	Al	D *
415	2-Amino-2-methyl-1-propanol	5	DNR	W	D
357	2-Amino-5-methylpyridine	5	DNR	W	D
424	1-Amino-8-naphthyl-4-sulfonic acid	5	DNR	WD	D
874	2-Amino-5-nitropyridine	Saturated solution	DNR	Al	D
632	p-Aminophenylacetic acid	5	DNR	W	D *
479	3-Aminopyridine	5	DNR	W	D
924	3-Aminoquinoline	5	DNR	Al	D *
627	2-Aminothiazole	5	DNR	Al	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
654	p-Aminovalerophenone	5	DNR	Al	D
	Ammonia gas	?	F	—	D
	Ammonia water	1	DNR	W	D
123	Ammoniacal copper carbonate	1/10	DNR	W	D
557	Ammonium fluoborate	5	DNR	W	D
113	Ammonium sulfamate	.5	DNR	W	D
367	n-Amyl alcohol	5	DNR	Al	D
367	n-Amyl alcohol	5 gms.	F	—	D
391	2-n-Amylpyridine	5	DNR	Al	D
394	4-n-Amylpyridine	5	DNR	Al	D
431	Anhydride, C9-10	5	DNR	W	D
385	Aniline	5	DNR	W	D **
63A	Aniline dye derivatives with wetting and penetrating properties	1	DNR	W	D
666	1-Anilino-2-propanol	5	DNR	Al	D *
526	Anthranilic acid	5	DNR	Al	D
387	Atabrine base	5	DNR	Al	D
386	Atabrine dihydrochloride	5	DNR	W	D
73	Azobenzene	Saturated solution	DNR	W	D
72	Azobenzene dust	25	P	—	D
	Azochloramide	1	DNR	Al	D
	Azochloramide triacetin	2	DNR	W	D
249	Benzalconium chloride	5	DNR	W	D
134	Benzoic acid	2½	DNR	Al	D *
23	o-Benzoic sulfimide	5	DNR	Al	D
696	N'-Benzoylsulfanilamide	Saturated solution	DNR	Al	D
679	p-Benzylaminophenol	5	DNR	Al	D **
621	Benzyl benzoate	5	DNR	Al	D
890	Benzyl carbanilate	5	DNR	Al	D
731	Benzylpyridinium	5	DNR	W	D
734	Benzylpyridiniumalkylbenzene sulfonate (1-3893-3)	5	DNR	W	D
729	Benzylpyridiniumalkylbenzene sulfonate (6-3893-3)	5	DNR	W	D
730	Benzylpyridiniumalkylbenzene sulfonate (10-3893-3)	5	DNR	W	D
949	Benzyl pyridinium salt of 2-mercaptobenzothiazole	5	DNR	O	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
555	Benzylpyridinium sulfonate	5	DNR	Al	D **
736	Benzylpyridinium trichloroacetate	Saturated solution	DNR	W	D
581	Benzyltriethanolammonium 2-(5-chloro)benzothiazyl sulfide	do	DNR	Al	D
416	Benzyltrimethylammonium chloride	5	DNR	W	D
	Betaine iodide, acidic	1	DNR	W	D
	Betaine iodide, basic	1	DNR	W	D
439	Beta thio-naphthol	Saturated solution	DNR	Al	D
24	Biphenyl (practical)	2	DNR	Al	D
30	(Aroclor 1242) Chlorinated Biphenyl	5 gms.	F	--	D
28	(Aroclor 1248) Chlorinated Biphenyl	5 gms.	F	—	D
504	2-Biphenylyl benzoate	Saturated solution	DNR	Al	D
27	o-Biphenylbiguanide	do	DNR	Al	D
641	Biphthalide	do	DNR	O	D
144	Bis(5-chloro-2-hydroxyphenyl) methane, monosodium salt	5	DNR	W	D
497	Bis(chloromethyl) ether	5 gms. in 18 cu. ft.	F	—	D **
381	Bisethylxanthogen	5	DNR	Al	D **
288	Bis(2-hydroxyethyl)3,3'-thiobis-(thiolpropionimidate hydrochloride)	Saturated solution	DNR	W	D
110	1,3-bis(hydroxymethyl) urea	2	DNR	W	D
208	Bis(isopropyl xanthogen)	5	DNR	Al	D
205	Bismuth subsalicylate	5	DNR	Al	D
540	N,N'-Bis(2-thiazolinylmercaptomethyl)thiourea	5	DNR	W	D
83	Bis(3,5,6-trichloro-2-hydroxyphenyl)methane, monosodium salt	1	DNR	W	D
921	Borated alkanolamine	5	DNR	W	D
553	Boron trifluoride $2H_2O$	5	DNR	W	D **
569	2-Bromopyridine	5	DNR	Al	D *
501	3-Bromopyridine	5	DNR	Al	D
763	Butadiene sulfone	5	DNR	Al	D
537	3-Butoxythiopropionamide	5	DNR	Al	D *
774	Butyl "carbitol" acetate	5	DNR	Al	D *
931	N-n-Butyllactamide	5	DNR	W	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
493	Butyl maleimide	10 gms.	F	—	D **
500	(n-Butyl p-hydroxybenzoate)	5	DNR	Al	D
560	tert-Butylphenol	2½	DNR	W	D
603	Butyl 2-pyridylethyl ether	5	DNR	Al	D **
607	Butyl 4-pyridylethyl ether	5	DNR	Al	D *
604	Butyl 4-pyridylpropyl ether	5	DNR	Al	D
788	Cadmium 2-ethylhexanoate	5	DNR	Al	D
	Cadmium sulfate	2	DNR	W	D
111	Calcium propionate	3	DNR	W	D
402	Carbazole	5	DNR	Al	D
58	Carbitol citrate	5	DNR	Al	D
792	Ca-Zn-Cu-Cd-Cro$_3$	5	DNR	WD	D
	Cerium nitrate	2	DNR	W	D
97	1-"cetyl blend" pyridinium chloride	5	DNR	W	D
462	Cetyldimethylethylammonium bromide	5	DNR	W	D
865	N-Cetyl-N-methyl-2,5-dimethylpyrrolidinium dibutyldithiocarbamate	5	DNR	W	D **
454	Cetyl pyridinium bromide	5	DNR	Al	D
473	Cetyltrimethylammonium bromide	5	DNR	W	D
	Chloramine	5	DNR	W	D
442	Chloramine T	5	DNR	W	D
601	Chlordan = 1,2,4,5,6,7,8,8-octachloro-4,7-methano-3a,4,7,7a-tetrahydroindane	5	DNR	Al	D
264	Chlorinated diethylbenzene, (chlorinated diethyl)	5	DNR	Al	D
674	Chloroacetaldehyde	10 gms.	F	—	D **
674	Chloroacetaldehyde	5	DNR	Al	D **
776	gamma-Chloroacetoacet-o-chloranilide	5	DNR	O	D
636	p-Chlorobenzoic acid	5	DNR	Al	D
580	2-(5-Chloro)benzothiazyldiethyldithiocarbamate	Saturated solution	DNR	Al	D
437	2-Chlorobiphenyl	5	DNR	Al	D
224	1-Chloro-2-Butanone	5 gms.	F	—	D *
648	p-Chlorobutyrophenone	5	DNR	Al	D
546	Chloromaleic anhydride	5	DNR	Al	D **

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
215	3-Chloro-1-mercapto-2-propanol	4 gms.	F	--	D *
948	5-Chloro-2-mercaptobenzothiazole	2½	DNR	WD	D
941	5-Chloro-2-mercaptobenzothiazole, cetylamine salt	5	DNR	AlD	D
942	5-Chloro-2-mercaptobenzothiazole, copper salt	5	DNR	W	D
959	5-Chloro-2-mercaptobenzothiazole, hydroxyethylpyridinium salt	Saturated solution	DNR	W	D
936	5-Chloro-2-mercaptobenzothiazole, laurylpyridinium salt	5	DNR	WD	D **
951	5-Chloro-2-mercaptobenzothiazole, nickel salt	5	DNR	WD	D
717	5-Chloro-2-methoxysuccinanilic acid	Saturated solution	DNR	W	D *
665	5-Chloro-2-methylbenzofuran	5	DNR	Al	D *
590	6-Chloro-2-methoxy-9-[3-(6-methoxy-8-quinolylamino)propylamino] acridine, dihydrochloride dihydrate	Saturated solution	DNR	Al	D
172	p-Chlorophenol polysulfide	5	DNR	Al	D *
370	p-Chlorophenyl allyl carbonate	5	DNR	Al	D
84	1-(4-chlorophenyl)-3,4-dimethyl-4-nitroso-pyrazol	5	DNR	Al	D
612	alpha-Chloropropionic acid	5	DNR	W	D **
379	beta-Chloropropionic acid	5 gms.	F	--	D
568	2-Chloropyridine	5	DNR	Al	D *
567	3-Chloropyridine	5	DNR	Al	D
762	o-Chlorostyrene	5	DNR	O	D
715	4-Chloro-d-tartranilic acid	5	DNR	W	D
269	p-Chlorothymol	1	DNR	Al	D
785	Chromic acetylacetonate	Saturated solution	DNR	O	D
786	Cobaltic acetylacetonate	5	DNR	Al	D
594	Copper acetate	5	DNR	W	D
68	Copper ammonium fluoride	1-250	DNR	W	D
68A	Copper ammonium fluoride	1-200	DNR	W	D
309	Copper ammonium salt of C8-10-ASA anhydrides	1	DNR	W	D
697	Copper mercaptobenzothiazole	5	DNR	Al	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		percent			
126	Copper oxide, colloidal red	1-400	DNR	W	D
561	Copper 8-quinolinolate	5	DNR	W	D
109	Copper (II) sulfamate	5	DNR	W	D
	Copper sulfate	2	DNR	W	D
840	p-Cresyl methyl sulfide (p-thiocresyl methyl ether)	5	DNR	Al	D
350	Crotonic acid	5	DNR	W	D
619	Cupric chloride	5	DNR	W	D **
620	Cuprous chloride	5	DNR	WD	D *
351	1-Cyano-1,3-bis(hydroxymethyl) guanidine	5	DNR	W	D
810	Cyanoacetamide	5	DNR	W	D
571	3-Cyanopyridine	5	DNR	W	D
262	3-Cyclohexenecarbonitrile	5	DNR	Al	D
262	3-Cyclohexenecarbonitrile	5 gms.	F	--	D
539	3-Cyclohexenethiocarboxamide	Saturated solution	DNR	Al	D **
709	2-Cyclohexylcyclohexanone	5	DNR	Al	D *
658	7-Cyclohexyl-2,3-dihydro-2-methylbenzofuran	5	DNR	Al	D
259	N-Cyclohexyl-N-furfurylideneamine	5	DNR	Al	D
765	Cyclopentanepropionic acid	5	DNR	Al	D **
766	2-Cyclopentene-1-valeric acid	5	DNR	Al	D **
772	Cysteine hydrochloride	5	DNR	W	D
488	1-(-)-Cystine	5	DNR	W	D
970	Di-alpha-phenylethylphenol	5	DNR	Al	D
869	2,6-diaminopyridine	5	DNR	W	D
285	Diamyl 3,3'-thiobis (thiolpropionimidate) (20% in 80% ethanol)	10	DNR	Al	D
45	6,8-Dianilino-1-naphthalenesulfonic acid	5	DNR	W	D
511	Dibenzyl sulfide	5	DNR	Al	D
512	Dibenzyl sulfoxide	5	DNR	Al	D
758	Dibromodichloromethane	5	DNR	Al	D
759	2,4-Dibromophenylglycine	5	DNR	Al	D
864	3,5-Dibromosalicylaldehyde oxime	Saturated solution	DNR	Al	D **
747	Dibutyl sulfone	5	DNR	W	D
120	p-Dichlorobenzene	2 gms.	F	--	D
282	3,4-Dichlorocyclohexenecarbonitrile	Saturated solution	DNR	Al	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
760	Dichlorodihydroxyethyl ether	5	DNR	Al	D **
613	2,3-Dichlorodioxane	5	DNR	Al	D **
681	Dichloroethane	5	DNR	Al	D
349	alpha, beta-Dichloro-N-(hydroxymethyl)acrylamide	5	DNR	W	D
647	5,7-Dichloro-2-methylbenzofuran	Saturated solution	DNR	Al	D
99	2,3-Dichloro-1,4-naphthoquinone	do	DNR	Al	D
787	2,4-Dichlorophenoxyacetic acid, morpholine salt	5	DNR	W	D **
519	2,4-Dichlorophenyl acetate	5	DNR	W	D **
894	2,4-Dichlorophenyl carbanilate	5	DNR	Al	D
218	2,3-Dichloropropylidene diacetate	5	DNR	Al	D **
637	4,5-Dichloro-3-pyridazone	Saturated solution	DNR	Al	D **
767	x,x-Dichlorostyrene	5	DNR	Al	D
767	x,x-Dichlorostyrene	3½ gms.	F	—	D **
700	Dicyclopentamethylene thiuram disulfide	5	DNR	O	D
595	N,N^{1}-Didodecyl-S-methyl-isothiourea, hydrochloride	2½	DNR	W	D
527	s-Di-2-ethylhexylthiourea	5	DNR	Al	D **
145	Diethyl ammonium isopropyl xanthate	5	DNR	W	D
	Diethylene glycol	4	DNR	W	D
371	Diethylenetriamine	5	DNR	Al	D
530	Di-(2-ethyl hexyl) ethylenethiocarbamide	5	DNR	Al	D
779	5,11-Diethylpentadecyl-8-sulfate	2½	DNR	W	D
646	2,3-Dihydro-2-methyl-5-phenylbenzofuran	5	DNR	Al	D
860	2,4'-Dihydroxybenzophenone	5	DNR	Al	D *
78	Dihydroxydichlorodiphenylmethane	2½	DNR	W	D
150	2,2'-Dihydroxy-5,5'-dichlorodiphenyl sulfide	5	DNR	Al	D
751	p,p'-Dihydroxydiphenylsulfone, sulfonated	5	DNR	W	D
469	1,1'-Dihydroxyethyl 2-pentadecyl imidazolonium chloride	5	DNR	W	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
839	beta,beta'-Dihydroxyethyl sulfide	5	DNR	W	D
721	p,p'-(4,6-Dihydroxy-m-phenylenediazo)dibenzoic acid	Saturated solution	DNR	W	D
533	Di(1-isobutyl 4-ethyl octyl) ethylene thiocarbamide	5	DNR	Al	D
54	Diisobutylphenoxyethoxyethyl dimethylbenzylammonium chloride	5	DNR	W	D
52	Diisobutyltoloxyethoxyethyldimethylbenzylammonium chloride	5	DNR	W	D
529	Diisopropylthiourea	5	DNR	Al	D *
260	Dimethylaminoethyl dodecanoate, ethyl sulfate quaternary	5	DNR	W	D **
458	2,6-Dimethyl-4-aminophenol	Saturated solution	DNR	Al	D
96	Dimethyldithiocarbamic acid, hemizinc (II) salt	5	DNR	W	D
556	Dimethyl glyoxine	Saturated solution	DNR	O	D
368	Dimethyl phthalate	5	DNR	Al	D
289	3,5-Dimethyltetrahydro-1,3,5,2-thiadiazine-2-thione	1½	DNR	Al	D
	Dimethylthiuramdisulfide	Saturated solution	DNR	Al	D
811	s-Dimethylurea	5	DNR	W	D
162	Di-beta-naphthol	Saturated solution	DNR	Al	D
22	Dinitro-o-cyclo hexyl phenol	1-200	DNR	W	D
141	4,6-Dinitro-2-sec-butylphenol, 4,4'-diaminodiphenylmethane salt	5	DNR	Al	D
140	4,6-Dinitro-2-cyclohexylphenol, 4,4'-diaminodiphenylmethane salt	5	DNR	Al	D
61	Dinitro-o-cresol, sodium salt	1	DNR	W	D
63	Dinitro-o-cresol, sodium salts	1	DNR	W	D
62	Dinitro-o-cresol and aromatic sulphonates, sodium salt	1	DNR	W	D
816	2,4-Dinitrophenyl thiocyanate	Saturated solution	DNR	W	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
369	Dioctyl phthalate	5	DNR	Al	D
	Dioxogen	1-15	DNR	W	D
24	Diphenyl (see Biphenyl)				
600	Diphenylacetic acid	5	DNR	Al	D **
275	1,5-Diphenylbiguanide formate	5	DNR	W	D
271	1,5-Diphenylbiguanide lactate	5	DNR	W	D
57	Diphenylcarbazide	5	DNR	Al	D
	Diphenyleneimine	Saturated solution	DNR	Al	D
67	Diphenylene oxide	do	DNR	Al	D
683	s-Diphenylethylenediamine	5	DNR	Al	D
821	Diphenylguanidine acetate	5	DNR	Al	D
303	Diphenyl guanidine-formaldehyde-mercapto benzothiazole, reaction product	5	DNR	O	D
723	1,3-Diphenylguanidine,mono-hypophosphite	5	DNR	W	D **
716	1,3-Diphenylguanidine,mono-phosphate	5	DNR	W	D *
18	Diphenylmethane	5	DNR	Al	D
17	Diphenyl oxide	5	DNR	O	D
17	Diphenyl oxide	Saturated solution	DNR	Al	C
753	Diphenyl sulfide, sulfonated	5	DNR	W	D
21	Diphenyl sulfone	5	DNR	Al	D
744	Diphenyl sulfone plus p,p' Dichloromethylsulfonate	5	DNR	W	D
20	Diphenyl sulfoxide	5	DNR	Al	D
611	Diphenylsulphonic acid	5	DNR	Al	D
532	s-Diphenylthiourea	5	DNR	WD	D
768	Dipropylene glycol monoisopropyl ether	5	DNR	Al	D
873	2,2'Dipyridylamine	5	DNR	Al	D
453	Dipyridylethyl mercaptoethane	5	DNR	Al	D
451	Dipyridyl ethyl sulfide	5	DNR	Al	D
932	Disodium Dimethylglyoxime	Saturated solution	DNR	W	D
856	Disodium N-dodecyl-N,N'-trimethylenebisdithiocarbamate	5	DNR	W	D
820	Disodium ethylenebis(N-2-cyanoethyldithiocarbamate	5	DNR	W	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
51	Disodium ethylenebis(dithiocarbamate)	2	DNR	W	D
963	Dithiobiuret	5	DNR	Al	R
828	Dodecylamine, glycolate	5	DNR	W	D *
829	Dodecylamine, hydrochloride	5	DNR	W	D *
719	Dodecylamine, monophosphate	Saturated solution	DNR	W	D
892	Dodecyl carbanilate	do	DNR	Al	D
564	Dodecyltrimethylammonium chloride	5	DNR	W	D *
435	Diacetyl	5	DNR	W	D
781	Diallyl chloromaleate	5	DNR	Al	D **
591	Diallyl ether	5	DNR	Al	D
778	Diallyl maleate	5	DNR	O	D **
496	3,4-Epoxy-1-butene	5 gms.	F	—	D *
609	Ethylene bromide	10 gms.	F	—	D **
680	Ethylene chlorohydrin	5	DNR	W	D
88	Ethylenebis(dithiocarbamic acid), manganese (II) salt	5	DNR	W	D
89	Ethylenebis(dithiocarbamic acid) Zinc (II) salt	5	DNR	W	D
678	Ethylene dichloride	5	DNR	Al	D
965	Ethylene glycol dibenzenesulphonate	5	DNR	Al	D
317	Ethylene glycol monoethyl ether	5	DNR	W	D
56	15% Ethylene oxide in Isopropyl Formate	10 gms.	F	—	D *
804	Ethylene oxide and mercaptobenzothiazole, reaction product	5	DNR	W	D
541	Ethylene bis(phenylthioacetamide)	Saturated solution	DNR	O	D
528	Ethylenethiocarbamide	do	DNR	W	D
702	1,3-Ethylenethiocarbamide	do	DNR	Al	D
964	Ethylenethiourea	do	DNR	Al	D **
376	2-Ethylhexanediol	5 gms.	F	—	D
775	2-Ethylhexoic acid	5	DNR	Al	D **
383	2-Ethylhexyl 2-chloropropionate	5 gms.	F	—	D
531	2-Ethylhexylethylenethiocarbamide	5	DNR	Al	D *
430	Ethyl maleate	5	DNR	W	D
733	Ethylpyridiniumalkylbenzenesulfonate	5	DNR	W	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
548	Fluoboric acid	5	DNR	W	D **
66	Fluorene	Saturated solution	DNR	O	B
626	Formaldehyde	10 gms.	F	--	D *
626	Formaldehyde	1	DNR	W	D
491	Formamide	5	DNR	W	D
684	Formic acid	5	DNR	W	D *
82	Furfural	1	DNR	W	D
169	Furfural acetophenone	5	DNR	Al	D
428	Furfuryl alcohol	5	DNR	W	D
585	1(+) Glutamic acid	Saturated solution	DNR	W	D
	Glyceroborate	50	DNR	Al	D
291	Glycerol tris(gamma-chloroacetoacetate)	5	DNR	Al	D
60	Glycerol laurate S	2½	DNR	W	D
525	Glycine N. F.	63	DNR	W	D **
490	Glycine ethyl ester, hydrochloride	5	DNR	W	D
881	Glycol dicarbanilate	Saturated solution	DNR	Al	D
80	Guanidine pentachlorophenate	2	DNR	W	D
713	2-Hendecyl-2-imidazoline	5	DNR	Al	D
712	2-(8'-Heptadecenyl)-2-imidazoline	5	DNR	Al	D
380	p-iso-Heptylphenol	5	DNR	Al	D *
722	1,6-Hexanediamine,dihypophosphite	5	DNR	W	D
724	1,6-Hexanediamine,monophosphate	5	DNR	W	D
100	2,4-Hexanedione,hemicopper (II) dvt.	1	DNR	Al	D
608	Hexyl 2-(6-methylpyridyl)ethyl ether	5	DNR	Al	D **
396	2-Hexylpyridine	5	DNR	Al	D
605	Hexyl 2-pyridylethyl ether	5	DNR	Al	D **
	Hexyl resorcinol	0.1	DNR	Stock	D
794	p-Hydroxybenzaldehyde	5	DNR	Al	D **
522	(2-Hydroxyethyl)-2-biphenylyl oxyammonium salt	Saturated solution	DNR	W	D **
294	1-(2-Hydroxyethyl)-2-imidazolinethione	5	DNR	Al	D
579	beta-Hydroxyethylpyridinium 2-(5-chloro)benzothiazyl sulfide	Saturated solution	DNR	Al	D *
552	Hydroxylamine hydrochloride	5	DNR	W	D **

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
586	1-Hydroxyproline	5	DNR	W	D
210	N-(1-Hydroxy-2,2,2-trichloroethyl) acetamide	5	DNR	Al	D
	Indoleacetic acid	1	Painted on stem	Lanolin	D
127	Iodine	7	DNR	Al	D
832	Iodoacetic acid	5	DNR	W	D **
115	Iron dimethyldithiocarbamate	5	DNR	W	D
872	Isocinchomeronic acid	Saturated solution	DNR	Al	D
572	dl-Isoleucine	5	DNR	W	D
	KADS (See Potassium acid aldehyde sulfonate				
732	Kerylpyridiniumalkylbenzenesulfonate	5	DNR	W	D
549	Kojic acid	5	DNR	W	D
183	Laurylamine	5	DNR	Al	D **
93	Laurylamine,pentachlorophenolate	5	DNR	Al	D
471	Lauryldimethylbenzylammonium chloride	5	DNR	W	D
206	Lauryl isoquinolinium bromide	5	DNR	W	D
837	2-(Laurylmercapto)-2-thiazoline	5	D	WD	D
419	Laurylpyridinium chloride	5	DNR	W	D
578	Laurylpyridinium-2-(5-chloro) benzothiazyl sulfide	Saturated solution	DNR	Al	D **
90	Laurylpyridiniumpentachlorophenolate	5	DNR	Al	D
574	dl-Leucine	Saturated solution	DNR	W	D
978	Lithium carbamate	5	DNR	W	D
979	Lithium chloride	5	DNR	W	D **
980	Lithium fluoride	5	DNR	W	D
981	Lithium sulfate	5	DNR	W	D **
575	dl-Lysine hydrochloride	5	DNR	W	D
550	Maleic acid	5	DNR	W	D **
688	Maleic acid copolymer	2½	DNR	W	D
423	Melamine	5	DNR	W	D
342	Mercaptothiazole	Saturated solution	DNR	W	D
91	2-Mercaptobenzothiazole	do	DNR	Al	D
945	2-Mercaptobenzothiazole, cetylamine salt	5	DNR	O	D *

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
106	2-Mercaptobenzothiazole, dicyclohexylamine salt	1	DNR	Al	D
92	2-Mercaptobenzothiazole, dodecylamine salt	5	DNR	Al	D
937	2-Mercaptobenzothiazole, hydroxyethyl pyridinium salt	5	DNR	W	D
952	2-Mercaptobenzothiazole, monoethanolamine salt	5	DNR	WD	D
938	2-Mercaptobenzothiazole, sodium salt with some sodium hydroxide	5	DNR	W	D
506	dl-Methionine	5	DNR	W	D
835	p-Methoxyphenol, sodium salt	5	DNR	W	D
524	Methyl anthranilate	5	DNR	Al	D **
534	N-(alpha-Methylbenzyl)thiocarbamide	Saturated solution	DNR	Al	D
807	4-Methylcarbostyril	do	DNR	Al	D
742	Methyl p-chlorophenyl sulfone	5	DNR	W	D
403	Methyl 2-4-dichlorophenoxyacetate	1	DNR	Al	D
606	Methyl 2-(5-ethylpyridyl)ethyl ether	5	DNR	Al	D *
623	Methyl p-hydroxybenzoate	5	DNR	Al	D *
834	2,2'-Methylenebis(4-chlorophenol), disodium salt	5	DNR	W	D
280	2,2'-Methylenebis(4-chloro phenoxyacetic acid)	Saturated solution	DNR	Al	D
845	2-Methylmercaptobenzothiazole	5	DNR	Al	D
426	2-Methyl-2-nitro-1-propanol	5	DNR	W	D
597	Methyl phenylacetate	5	DNR	Al	D **
373	2-(Methylphenylamino)thiazoline	5 gms.	F	—	D **
764	alpha-Methylstyrene	5	DNR	Al	D
761	x-Methylstyrene	5	DNR	O	D *
	Monochloroacetic acid	1	DNR	W	D
5	Mono-n-dodecylamine acetate	1	DNR	W	D
9	Mono-n-hexadecylamine acetate	1	DNR	W	D
36	Morpholine	10	DNR	W	D
261	Morpholine disulfide	Saturated solution	DNR	Al	D
617	Mucic acid	5	DNR	W	D
616	Mucochloric acid	5	DNR	Al	D **
638	Mucochloric acid semicarbazone	5	DNR	AlD	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
132	Naphthalene acetamide	1-5000	DNR	W	D
131	Naphthaleneacetic acid	1-5000	DNR	W	D
298	beta-Naphthol	5	DNR	W	D
116	beta-Naphthoxyacetic acid	20:1,000,000	DNR	W	D
107	2-(2-Naphthoxy)ethanol	1	DNR	Al	D
117	Naphthylmethyl acetate	1 gm. in 144 cu. ft.	F	—	D
118	Naphthylmethyl thiocyanate	do	F	—	D
101	2-Naphthyl propionate	1	DNR	Al	D
796	Nickel benzoate	5	DNR	AlD	D
514	Nickel di-n-hexyldithiocarbamate	1	DNR	W	D
800	Nickel 8-hydroxyquinolate	5	DNR	AlD	D
	Nickel nitrate	2	DNR	W	D
797	Nickel pectinate	2½	DNR	W	D
795	Nickel salicylate	5	DNR	AlD	D
354	Nickel sulfate	1	DNR	W	D
390	Nickel stearate emulsion	5	DNR	WD	D
799	Nickel thiocyanate	5	DNR	Al	D **
871	Nicotinamide U.S.P.	5	DNR	W	D
720	p-Nitrobenzenediazohydroxide, sodium salt	5	DNR	W	D
809	p-Nitrobenzoic acid	5	DNR	W	D
75	o-Nitrobiphenyl	5	DNR	Al	D
434	Nitroethane	5	DNR	W	D
	Nitrogen trichloride	5	F	—	D
893	2-Nitro-2-methylpropyl carbanilate	5	DNR	Al	D
85	n-Nitrosophthalimidine	Saturated solution	DNR	Al	D
468	Octadecyldimethylbenzylammonium chloride	5	DNR	W	D
81	Octadecenyldimethylethylammonium bromide	5	DNR	W	D
465	9-Octadecenyldimethylethylammonium bromide	5	DNR	W	D
562	Octadecyltrimethylammonium chloride	5	DNR	W	D *
47	Octadecyltrimethylammonium pentachlorophenate 34% plus 4% other active quaternaries	5	DNR	W	D
583	Octylphenoxyethoxyethyldimethylbenzylammonium chloride	5	DNR	W	D *

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
1005	n-Octyl thiocyanate	5	DNR	Al	D *
545	Oxalic acid	5	DNR	W	D
634	Mixed oxazolines	5	DNR	WD	D *
	Ozone	?	F	—	D
499	Paraformaldehyde	5	DNR	W	D
247	Paraformaldehyde-camphor (75:25) mixture	50 gms. in 18 cu. ft.	F	—	D
803	Pentachlorophenyl laurate	Saturated solution	DNR	Al	D *
108	(Pentachlorophenoxy)acetic acid	1	DNR	Al	D
102	2,4-Pentanedione, hemicopper (II) dvt.	Saturated solution	DNR	W	D
87	Phenanthraquinone	do	DNR	Al	D
633	beta-Phenethylamine	5	DNR	Al	D *
320	Phenothiazone	Saturated solution	DNR	W	D
25	1-Phenoxypropanediol-2,3	4	DNR	W	D
599	Phenylacetamide	5	DNR	Al	D
598	Phenylacetic acid	5	DNR	Al	D **
573	dl-Phenylalanine	Saturated solution	DNR	W	D
459	2-Phenyl-4-aminophenol	5	DNR	Al	D
967	Phenyl biguanide, hydrochloride	Saturated solution	DNR	Al	D
378	Phenyl cellusolve acrylate	5 gms.	F	—	D
703	o-Phenylenethiourea	Saturated solution	DNR	Al	D
969	alpha-Phenylethylphenol	5	DNR	Al	D **
510	o-Phenylphenol, tetra(2-hydroxyethyl)ammonium salt	Saturated solution	DNR	W	D **
507	o-Phenylphenol, barium salt - dust	20	BD	T	D
508	o-Phenylphenol, zinc salt (dust)	100	P	—	D **
640	Phthalide	5	DNR	Al	D
694	Phthalylsulfathiazole	5	DNR	WD	D
784	Phosphotungstic acid	5	DNR	W	D
388	alpha-Picoline	5	DNR	W	D
389	beta-Picoline	5	DNR	W	D
	Pine Oil	1	DNR	E	D
823	Piperidinium N-pentamethylenedithiocarbamate	5	DNR	WD	D
292	Polyethylene amine	5	DNR	W	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
436	Polyethylene glycolmono-isooctyl phenylether	5	DNR	W	D
690	Polyvinyl acetate emulsion	10	DNR	W	D *
686	Polyvinyl alcohol	2½	DNR	W	D
687	Polyvinyl alcohol	2½	DNR	W	D
	KADS - Potassium acid aldehyde sulfonate				
329	KADS-sec-Amylbenzene condensation product	5	DNR	W	D
327	KADS-aniline condensation product	5	DNR	W	D
743	KADS-p-tert-butylphenol condensation product	5	DNR	W	D
321	KADS, Chlorinated phenol condensation product	5	DNR	W	D
333	KADS, chlorobenzene monochloro, condensation product	5	DNR	W	D
345	KADS-4-chlorophenol condensation product	5	DNR	W	D
343	KADS-4-chloro-o-phenylphenol condensation product	5	DNR	W	D
328	KADS-mixed Cresol condensation product	5	DNR	W	D
752	KADS,2,4-dichlorophenol	5	DNR	W	D
338	KADS-2,4-dichlorophenol condensation product	Saturated solution	DNR	W	D
750	KADS,p,p'-Dihydroxydiphenylsulfone, condensation product	5	DNR	W	D
754	KADS, dimercaptal of benzyl mercaptan	5	DNR	W	D
755	KADS, dimercaptal of thiophenol	5	DNR	W	D
748	KADS-diphenyldisulfide condensation product	5	DNR	W	D
749	KADS-Diphenyl sulfide condensation product (761)	5	DNR	W	D
746	KADS-diphenyl sulfide condensation product (761A)	5	DNR	W	D
339	KADS, hydroquinone condensation product	5	DNR	W	D
325	KADS, o-hydroxybiphenyl condensation product	5	DNR	W	D
341	KADS, 4-p-hydroxyacetophenone condensation product	5	DNR	W	D
324	KADS,p-Hydroxybiphenyl condensation product	2½	DNR	W	D
326	KADS, monochloro	5	DNR	W	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
334	KADS, monochlorophenol condensation product	5	DNR	W	D
335	KADS-naphthalene condensation product	5	DNR	W	D
741	KADS, Naphthalene condensation product	5	DNR	W	D
340	KADS, 2-naphthol, condensation product	Saturated solution	DNR	W	D
336	KADS-beta-Naphthol condensation product	5	DNR	W	D
330	KADS, orthocresol condensation product	5	DNR	W	D
337	KADS-phenol condensation product H_2SO_4	5	DNR	W	D
344	KADS-phenol formaldehyde condensation product	5	DNR	W	D
332	KADS, phloroglucinol condensation product	Saturated solution	DNR	W	D
323	KADS, pyrogallol condensation product	5	DNR	W	D
322	KADS, resorcinol condensation product	Saturated solution	DNR	W	D
740	KADS-Thiophenol condensation product	5	DNR	W	D
331	KADS thymol condensation product	5	DNR	W	D
928	Potassium cyanate	5	DNR	W	D
	Potassium permanganate	2	DNR	W	D
397	2-Propanolpyridine	5	DNR	Al	D
401	4-Propanolpyridine	5	DNR	Al	D
489	Propionamide	5	DNR	W	D
769	1-iso-Propoxy-2-propanol	5	DNR	Al	D
382	beta-iso-Propoxypropionic acid	5	F	—	D
882	Propylene dicarbanilate	5	DNR	Al	D
248	Propylene glycol	20	DNR	W	D
705	Propylene glycol dipropionate	5	DNR	W	D
498	Propylene oxide	10 gms.	F	—	D **
667	iso-Propyl-alpha-chloropropionate	5	DNR	Al	D
668	iso-Propyl beta-chloropropionate	5	DNR	Al	D *
833	4,4'-iso-Propylidenediphenol, disodium salt	5	DNR	W	D
188	iso-Propylxanthogenyldiethylamide	5 gms.	F	—	D *

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
372	iso-Propylxanthogenyldimethylamide	5	DNR	Al	D **
346	Pyridine	10	DNR	W	D
861	3-Pyridol	5	DNR	Al	D
875	2-Pyridone	5	DNR	W	D
450	2-Pyridylethyl n-butyl sulfide	5	DNR	Al	D
452	2-Pyridylethyl n-cetyl sulfide	5	DNR	Al	D
870	3-Pyridylnitrile	5	DNR	W	D
433	Pyruvic acid	5	DNR	W	D
735	quartenary ammonium compound	5	DNR	W	D
738	Quartenary ammonium compound	5	DNR	W	D
143	Quatenary ammonium salt, water-soluble	5	DNR	W	D *
554	Quebracho extract	5	DNR	W	D
400	Quinaldine	5	DNR	Al	D
398	Quinoline	5	DNR	Al	D
399	iso-Quinoline	5	DNR	Al	D
542	8-Quinolinol	Saturated solution	DNR	W	D **
544	8-Quinolinol benzoate	do	DNR	W	D **
877	8-Quinolinol, chloroacetate	5	DNR	W	D *
802	8-Quinolinol salicylate	5	DNR	WD	D *
551	Quinoline-8-sulfonic acid	Saturated solution	DNR	W	D
806	8-Quinolinol tartrate	5	DNR	W	D
547	Rhodanine	Saturated solution	DNR	O	D
706	Salicylanilide	5	DNR	Al	D
50	Salicylanilide, sodium salt	5	DNR	W	D
136	Salicylic acid	2½	DNR	Al	D **
136	Salicylic acid	2½	DNR	WD	D **
782	Silicotungstic acid	5	DNR	W	D
878	Silver ammonium complex of succinic acid	1	DNR	W	D
791	Silver chromate	5	DNR	WD	D
142	Silver thiourea	.8	DNR	W	D
348	Sodium 3-acetyl-4-oxycoumarin	5	DNR	W	D
818	Sodium alkyl sulfonate	5	DNR	W	D
133	Sodium benzoate	2½	DNR	W	D
822	Sodium 2-benzothiazyl sulphide	5	DNR	W	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
253	Sodium bisphenol	1¼	DNR	WWE	D
347	Sodium 3-carbethoxy-4-oxy-coumarin	5	DNR	W	D
	Sodium carbonate	5	DNR	W	D
930	Sodium 2-chloro-6-naphthalenesulfonate	5	DNR	W	D
929	Sodium p-chlorophenylcyanamide	5	DNR	WD	D **
274	Sodium cinnamate	5	DNR	W	D
643	Sodium copper polyphosphate	5	DNR	W	D
926	Sodium cyanamide	5	DNR	W	D
836	Sodium(2,4-dichlorophenoxy)acetate	5	DNR	W	D
	Sodium dichromate	½	DNR	W	D
44	Sodium dimethyldithiocarbamate	5	DNR	W	D
615	Sodium 2,4-dinitrobenzenesulfonate	Saturated solution	DNR	W	D
854	Sodium N-dodecyl-N-(2-cyanoethyl) dithiocarbamate	5	DNR	W	D **
422	Sodium formaldehyde sulfoxylate	5	DNR	W	D
558	Sodium fluoborate	5	DNR	W	D
559	Sodium glycerophosphate	5	DNR	W	D
	Sodium hydroxide	1	DNR	W	D
685	Sodium hypo chlorite	1	DNR	W	D
315	Sodium lauryl sulfate	5	DNR	W	D
644	Sodium lead polyphosphate	Saturated solution	DNR	W	D
272	Sodium 2-Mercapto-4,5-dimethylthiazole	5	DNR	W	D
855	Sodium N-3-(methyldodecylamino) propyl dithiocarbamate	5	DNR	W	D **
933	Sodium 2-naphthoxide (crude, 50%)	5	DNR	W	D **
513	Sodium phenylcyanamid	5	DNR	W	D **
	Sodium polysulfide	1-40	DNR	W	D
112	Sodium propionate	3	DNR	W	D
135	Sodium salicylate	2½	DNR	W	D *
757	Sodium thiocarbonate	5	DNR	W	D
209	Sodium 2-thiophenecarboxylate	5	DNR	W	D
934	Sodium p-toluate	5	DNR	W	D
563	Soy trimethylammonium chloride	5	DNR	W	D
737	Stearyldimethylbenzylammonium chloride	5	DNR	W	D
689	Styrene emulsion, plasticized	10	DNR	W	D
695	Succinyl sulfathiazole	Saturated solution	DNR	Al	D

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
691	Sulfanilamide USP powder	Saturated solution	DNR	Al	D
692	Sulfathiazole	do	DNR	Al	D
79	Nacconol H. G., 60% sulfonate 40% sodium sulfate	10	DNR	W	D
	Sulfur dioxide	1	F	--	D
815	Sulphocarboxylic acid ester	5	DNR	W	D
565	Tallow trimethylammonium chloride	5	DNR	W	D *
718	d-Tartranilic acid	5	DNR	W	D *
486	Taurene	5	DNR	W	D
76A	o-Terphenyl	5	DNR	Al	D
76A	o-Terphenyl		PW		D
77	m-Terphenyl	5	DNR	O	D
77	m-Terphenyl	5	DNR	Al	D
77	m-Terphenyl		PW		D
76	p-Terphenyl	5	Brushed on stem end	Al	D
310	Tetrabromo-o-cresol	5	DNR	Al	D **
98	Tetrachloro-p-benzoquinone	5	DNR	W	D
517	Tetrachlorophenyl acetate	5	DNR	W	D **
463	N-Tetradecyl-N'-dimethyl-N'-benzyl-1,3-propylene diammonium chloride	5	DNR	W	D
197	p-(1,1,3,3-Tetramethylbutyl) phenol	5	DNR	Al	D
159	p-(1,1,3,3-Tetramethylbutyl) phenoxyethoxyethylisothiouronium hydrochloride	5	DNR	Al	D
71	Tetramethyl thiuramdisulfide	4	DNR	W	D
263	1,2,3,4,6,9-Tetrathiadiazecane	5	DNR	WD	D
536	3-(2-Thiazolin-2-ylmercapto) thiopropionamide	5	DNR	WD	D
844	Thiobenzanilide	5	DNR	Al	D
147	Thiocarbamyl bis (dimethyl sulfenamide)	Saturated solution	DNR	Al	D
842	p-Thiocresol	5	DNR	Al	D *
849	Thiodiphenylamine	Saturated solution	DNR	Al	D
841	Thioglycolic acid	5	DNR	W	D **

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
704	iso-Thiohydantoin	5	DNR	W	D
847	Thio-beta-naphthol	Saturated solution	DNR	Al	D
838	Thiophene	5	DNR	Al	D
857	Thioureylenebis (dimethyl-dodecyltrimethylenammonium) dichloride	5	DNR	W	D
714	dl-Threonine	5	DNR	W	D
677	Thymol	5	DNR	Al	D **
968	o-Tolylbiguanide, hydrochloride	Saturated solution	DNR	Al	D
447	1-p-Tolyl-3,5-dimethyl-4-nitrosopyrazole	2	DNR	Al	D
850	s-Di-o-Tolyl-thiourea	5	DNR	AlD	D
427	Trichloroacetic acid	5	DNR	W	D
614	2,2,3-Trichlorobutyric acid	5	DNR	W	D **
523	2,4,5 Trichlorophenol	2½	DNR	W	D *
105	2,4,5-Trichlorophenol acetate	1	DNR	Al	D
104	2,4,5-Trichlorophenol chloroacetate	1	DNR	Al	D
516	2,4,6 Trichlorphenyl acetate	5	DNR	W	D **
446	Triethanolamine	5	DNR	W	D
270	Triethylene glycol	5	DNR	W	D
293	Triethylene glycol di-(gamma-chloroacetoacetate)	5	DNR	Al	D
475	Trimethyloctadecenyl and trimethyloctadecadienyl ammonium chlorides mixed	5	DNR	W	D *
624	Triphenyl 3,4-dichlorobenzyl phosphonium chloride	5	DNR	Al	D
817	Triphenyl 3,4-dichlorobenzyl phosphonium thiocyanate	5	DNR	Al	D
922	Tris(2-ethylhexyl) borate	5	DNR	Al	D **
417	Tris(hydroxymethyl)aminomethane	5	DNR	W	D
	Trisodium phosphate	1	DNR	W	D
195	Trithiodibutylamine	2½ gms.	F	--	D
153	N,N'-Trithiodimethylamine	2½ gms.	F	--	D
923	Tri-(2,4,5-trichlorophenyl) phosphate	5	DNR	W	D
505	dl-Tryptophane	5	DNR	Al	D
783	Tungstic acid	5	DNR	AlD	D
771	Undecylenic acid	5	DNR	Al	D **
830	Urea, monosulfate	5	DNR	W	D **

Our accession No.	Chemical used	Maximum Concentration	How Treated	Solvent or diluent	Results
		Percent			
576	dl-Valine	5	DNR	W	D
374	Vinyl-n-butyl ether	1½ gms.	F	--	D *
392	2-Vinylpyridine	5	DNR	Al	D
	Zinc chloride	½	DNR	W	D
635	Zinc m-chlorobenzoate	Saturated solution	DNR	Al	D
858	Zinc chlorohexyl chlorocarbamate	5	DNR	AlD	D
582	Zinc 5-chloro-2-mercaptobenzothiazole	5	DNR	Al	D
114	Zinc dimethyldithiocarbamate	6	DNR	W	D
699	Zinc N-ethyl-N-(beta-cyanoethyl) dithiocarbamate	Saturated solution	DNR	Al	D
698	Zinc ethylenebis(N-2-cyanoethyl)dithiocarbamate	2½	DNR	W	D
669	Zinc ethylenebis(dithiocarbamate)	5	DNR	WD	D
701	Zinc mercaptobenzothiazole	5	DNR	Al	D
618	Zinc sulfocarbolate	5	DNR	W	D